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# Comparison of Reactive and Hybrid Routing Protocols in MANET Networks using FTP Applications

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**ABSTRACT:** In modern technology era, the endeavor of MANET is to provide proficient wireless communication by adopting adhoc routing functionality in mobile nodes. The MANET nodes result in frequent network topology changes, making routing a challenging task. In past, reactive routing approaches are used as a popular technique that provides scalable solution to relatively large MANET networks, where hybrid MANET routing algorithms are introduced comprises of both reactive and proactive routing properties. This work is an attempt towards a comprehensive performance evaluation of commonly used reactive Ad hoc On-Demand Distance Vector (AODV) and Dynamic Source Routing (DSR) protocols with hybrid Geographic Routing Protocol (GRP) routing algorithm under varying node density conditions in term of Quality of service(QoS). Although, the performance of GRP protocol is better than the AODV and DSR protocol but normalized routing load have to be optimized in which GRP under performance than other protocols for IEEE 802.11g MANET networks.

**KEYWORDS:** MANET, AODV, DSR, GRP, OPNET modeler 14.5

## I. INTRODUCTION

Wireless networks play a very prominent role in day to day communication. It is widely used in military & civilian applications, search and rescue, temporary meeting rooms & airports, industrial applications and even in personal area networks [1]. There are two types of wireless networks; Infrastructure Network and Infrastructure-less Network. Infrastructure network contains fixed and wired gateways whereas infrastructure-less network contains multi hop wireless nodes and it has no fixed infrastructure [2]. MANET is the second type. A Mobile ad hoc networks(MANET) is a temporary wireless network in which mobile nodes are communicated with each other without an infrastructure [3]. MANET is a fast rising area of research. The goal of the routing protocol is to have an efficient route establishment between a pair of nodes, so message can be delivered in a timely manner. Bandwidth and power constraint are the important factors to be considered in current wireless network because multi-hop ad-hoc wireless relies on each node on the network to act as a route and packet forwarder. Routingin MANET is difficult since mobility cause frequent network topology changes & requires more robust and flexible mechanism to search for and maintain route. When the network Nodes more, the establishedpaths may break and the routing protocol must dynamically search for other feasible route [4]. These protocols can be divided into three categories proactive, reactive and hybrid. Proactive protocols maintain route to all nodes, including nodes to which no packets are sent. In determined only when they are explicitly needed to forward packets. Hybrid method combine Proactive and reactive methods to find efficient routes, without much control overhead [5]. Ad-hoc on demand vector protocol(AODV) builds route using a route request/route reply query cycle. when a source node desires a route to a destination for which it does not already have a route, it broad-caste a route request (RREQ) packet across the network Nodes receiving this packet update their information for the source node and set up backwards pointers to the source node in the route tables. In addition to the source node's IP address, current sequence number, and broadcast ID, the RREQ also contains the most recent sequence number for the destination of which the source node is aware [6]. If this is the case, it unicasts a RREP back to source, otherwise, it rebroadcasts the RREQ. Nodes keep track of the RREQ's source IP address and broadcast ID of better route If they receive a RREQ which they have already processed, they discard the RREQ and don’t forward it. As long as the route remains active, it will continue to be maintained. A route is considered active as long as there are data packets periodically travelling from the source to destination along that path. Once the source stops sending data packets, the

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links will time out and eventually be deleted from intermediate node routing. After receiving the RERR, if source node still desires route, it can reinitiate route discovery [7]. Dynamic source routing (DSR) Computes the routes when necessary and then maintains the same during the entire communication network. Source routing is a technique in which the sender of a packet determines the complete sequence of nodes through which the packet has to pass; the sender explicitly lists this route in the packet's header identifying each forwarding hop'' by the address of the next node to which to transmit the packet on its way to the destination host [8]. Geographic routing protocol (GRP) is example of hybrid routing which the concept of geographic routing for the exchange the information. Position based routing or geographic routing is used to eliminate the limitation of topology based routing. It gives the better performance is dynamic topologies or networks [9].

Das et al. [10] evaluated theperformance with respect to fraction of packets delivered, end-to-end delay and routing load for a given traffic and mobility model. Authors observed that the new generation of on-demand routing protocols use a much lower routing load. However,the traditional link state and distance vector protocols provide, in general, better packet delivery and delay performance. Singh H. et al. [11] demonstrated the comparative analysis from the simulation is observed for random behavior of these protocols using application-oriented matrices such as Delay, Network load, PDR, Normalized Routing Load and results showed that hybrid GRP routing protocol is the best suited over reactive AODV protocol for IEEE 802.11n MANET networks in dense population of nodes, where GRP has very poor NRL response under the used simulation parameters.

This research paper is concentrated on the evaluation of performance comparison of reactive protocol (AODV, DSR) and hybrid protocol (GRP) as these the best suited for MANET in their routing algorithmic classifications on IEEE 802.11g MANET networks.

This paper is further divided into four different sections. In section 1, the introduction of AODV, DSR, GRP routing protocol is presented. Section 2, describes the simulation setup for the evaluation of the AODV, DSR, GRP protocol. In section 3, results, discussions and comparison of AODV, DSR, GRP has been given. Section 4, covers the conclusion of this research work.

## II. SYSTEM DESCRIPTION

System has been designed different MANET scenarios with different network sizes i.e. 50×50 $m^2$, 100×100 $m^2$, 150×150 $m^2$, 200×200 $m^2$ with network node density 20, 40, 60 and 80 respectively. With varying network area numbers of nodes are chosen because with the increase in network size the congestion increases and it will affect the network performance. The performance of different routing protocols i.e. AODV, DSR and GRP is evaluated in different network scenarios of MANET. The traffic flows randomly between the workstations. The different DCF-MAC protocol implementation parameters are shown in Table I. The buffer size of data is set to 2024 kbps for each mobile workstation at data rate of 54 Mbps with 802.11g PHY layer and DCF- MAC Protocol implementation with parameters given in Table 1. The traffic flows randomly between different workstations placed at different distances in different scenarios. The network model considered for the evaluation of the AODV, DSR and GRP protocol is shown in Fig 1.

Table I: Parameters of IEEE 802.11g MANET

| | |
|---|---|
| Routing Protocol | AODV, GRP, DSR |
| Wireless LAN MAC Address | Auto Assigned |
| Physical Characteristics | IEEE 802.11g |
| Data Rates | 54 Mbps |
| Transmit Power | 0.005 |
| RTS Threshold | 256 |
| Packet- Reception Threshold | -95 |
| Buffer Size | 1024 Kbps |

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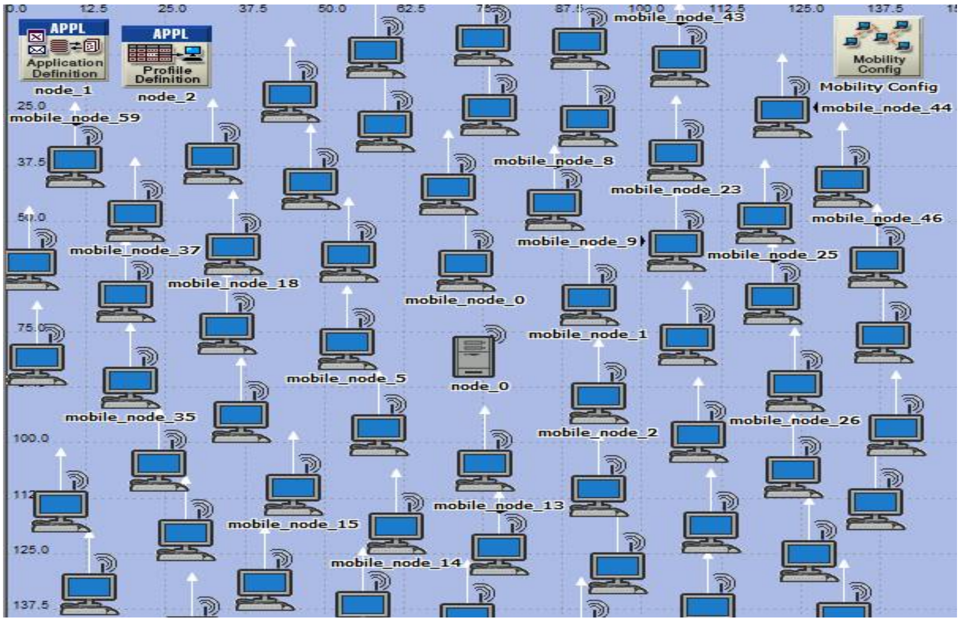

**Fig.1:** Mobile Model of 60 Nodes MANET

## III. RESULTS AND DISCUSSIONS

To evaluate the overall performance comparison of various protocols i.e. AODV, DSR and GRP, have been determined the various QoS parameters such as End-to-End Delay, the number of hops per route, network load, normalized routing load and packet delivery ratio(PDR) for MANET network

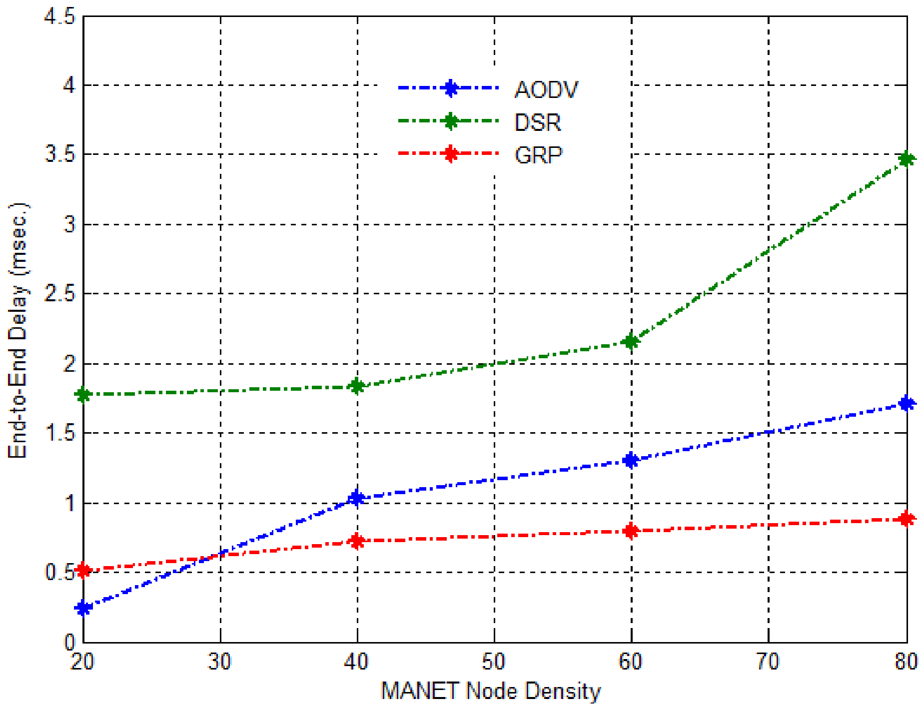


Fig. 2 End-to-End delay using different routing Schemes at Different Node Density

Fig 2 calculates the end-to-end delay of each transmitted data packet during the simulation period as a function of node density and includes all possible delays caused by buffering during route discovery latency. From the graph it is observed that delays of GRP are lower as compared to other two protocols. However, AODV delay is less at lower node density i.e. 0.244 msupto 20 nodes for AODV, 0.517 msupto 20 nodes for GRP and 1.776 msupto 20 nodes for DSR. But, with increase in node density performance of AODV and DSR deteriorates as compared to GRP in terms of delay i.e. 1.2994 ms for AODV, 0.7973 ms for GRP and 2.1623 ms for DSR at 60 nodes. AODV delays are higher due to the various retransmission attempts until data can be successfully transmitted as shown in Fig.2. In AODV, destination node gets request message from the sender node, if it has no route for the destination node, it again broadcasts the message and increases height of the node. In this way it retransmits the packet until it does not get the required route for destination. Higher delays in DSR protocol are due to network congestion. Due to congestion control messages in case of DSR are lost and delayed due to establishment of new route.

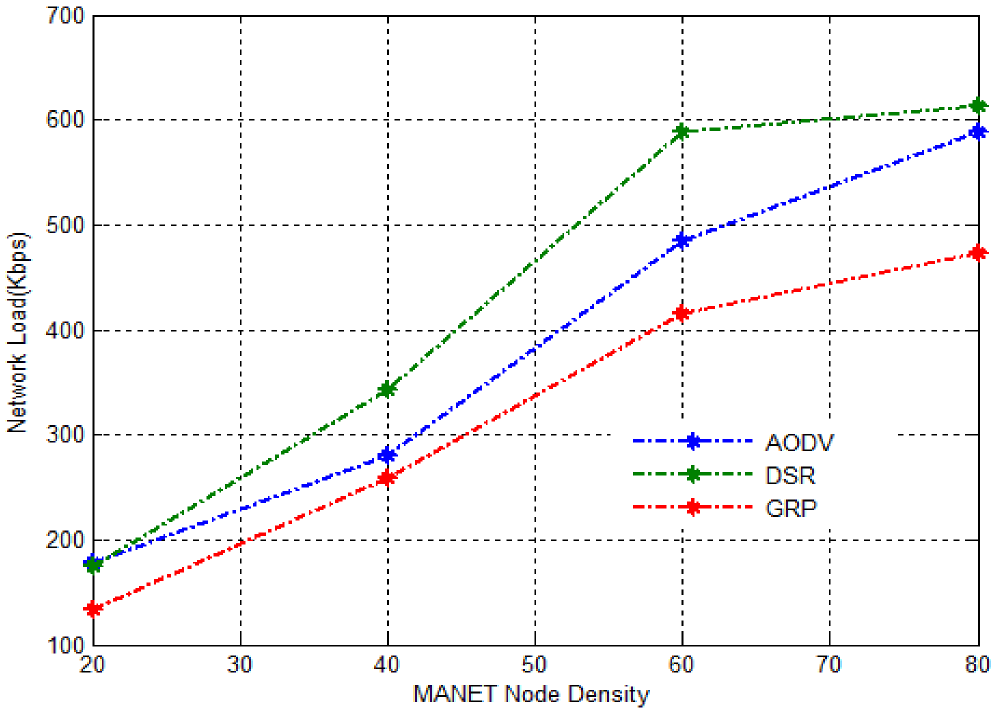


Fig. 3 Network Load using different routing Schemes at different Node Density

Fig 3 calculates the overall network load as a function of node density. From the graph it is observed that network load of GRP is lesser at lower node density as well as at higher node density as compared to other two protocols. The network load is 178.880 kbps for AODV, 133.962 kbps for GRP and 165.342 kbps for DSR for 20 nodes and 589.3196 kbps for AODV, 473.5924 kbps for GRP and 614.1413 kbps for DSR for 80 nodes. AODV network load is high because AODV protocol keeps very little network information in its cache which causes AODV to depend on a route discovery process more often and resulting in increase of network overhead

Fig 4 calculates the packet delivery ratio i.e. ratio of number of packets received to the number of packets sent using different routing scheme at different node density. From the graph it is observed that packet delivery ratio of GRP is higher as compared to DSR and AODV. It has been seen that at lower node density the PDR difference between all three protocols is less i.e. 0.996579 at 20 nodes for AODV, 0.99652 at 20 nodes for GRP and 0.99425 at 20 nodes for DSR. But this difference increases with increase in node density i.e. 0.863599 at 80 nodes for AODV, 0.902487 at 80 nodes for GRP and 0.871163 at 80 nodes for DSR. But performance of GRP still remains best as compared to other two protocols. The reason of poor PDR is clustering of nodes with the presence of high traffic. With the increase in node density the clustering between nodes increases due to high traffic affecting the rate of transmission of packets.

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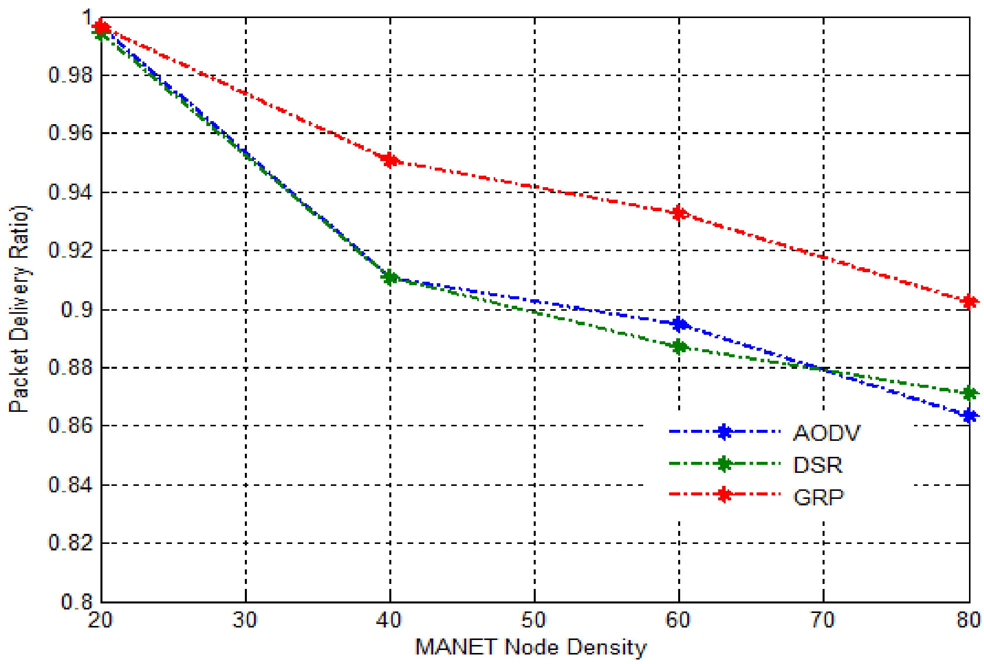


Fig. 4 PDR using different routing Schemes at different Node Density

Fig 5 calculated the number of hops per route that represents the number of hops in each route to every destination in the route cache of all nodes in the network. The performance of AODV and GRP is almost same in terms of number of hops. Both protocols use less number of hops for transmission of packets as that of DSR.

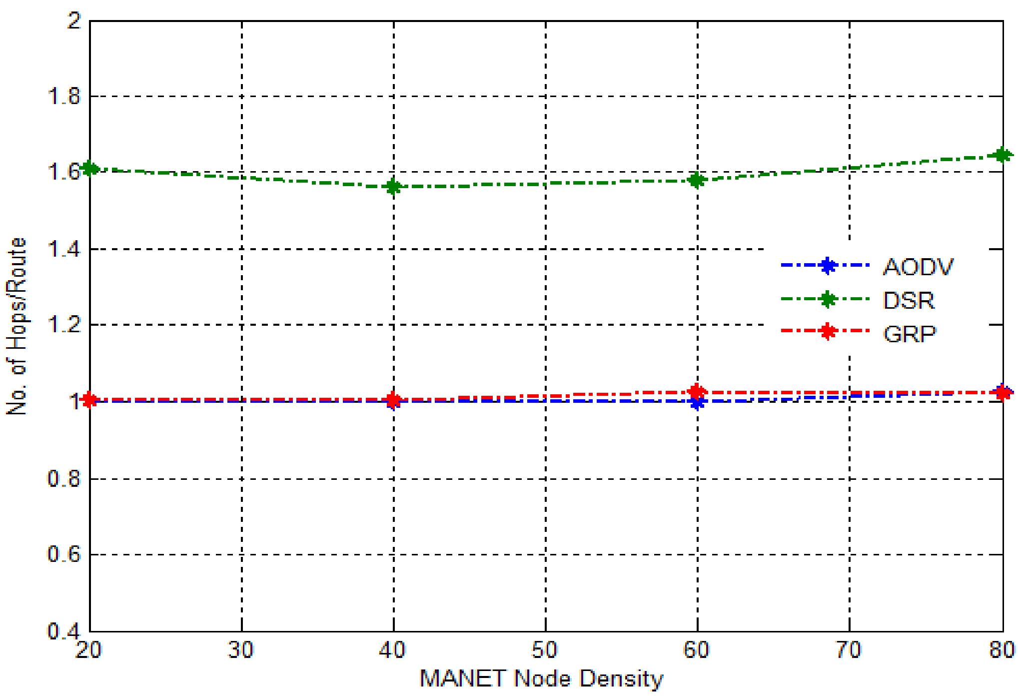


Fig. 5Number of Hops per Route using different routing Schemes at different Node Density

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Fig 6 calculates the normalized routing load as a function of node density i.e. ratio of all routing control packets sent by all nodes over the number of received data packets at the destination nodes. From the graph it is observed that GRP and AODV performance decays in terms of normalized routing load. The impact of NRL is lower at DSR protocol. The difference between NRL of AODV and GRP decreases with increase in network node density.

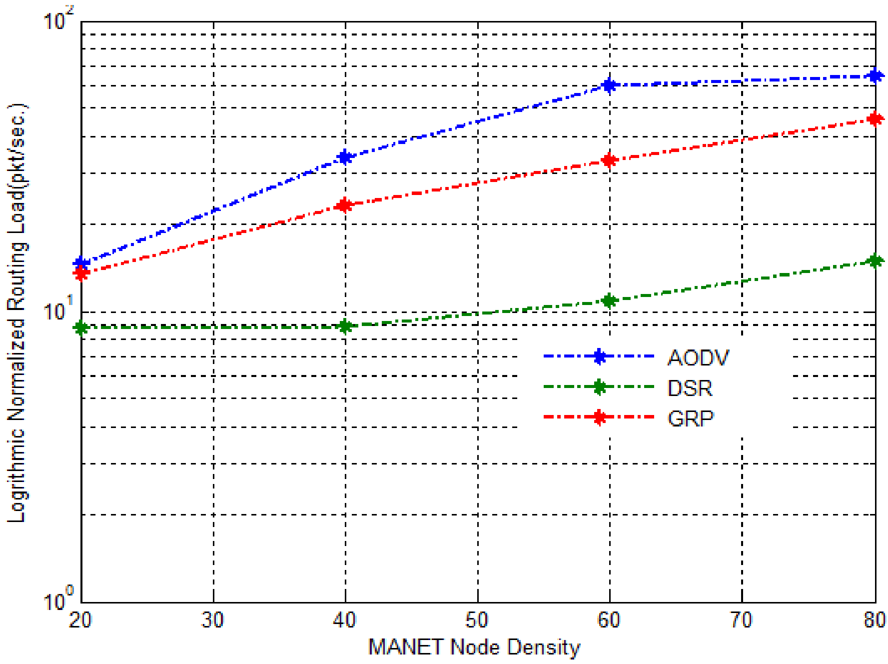


Fig. 6 NRL using different routing Schemes at different Node Density

## IV. CONCLUSION

This work compares the performance of AODV, DSR and GRP based route information for IEEE 802.11g MANET to demonstrate the impact of these protocols with varying node density. The comparative analysis is carried out for random behavior of these protocols using application-oriented matrices such as End-to-End delay, network load, packet delivery ratio, number of hops per route and normalized routing load. Hybrid GRP outperforms reactive AODV and DSR routing protocol in terms of delay, network load, packet delivery ratio under high data rates of IEEE 802.11g standard. It is also reported that, the performance of GRP protocol is better than the AODV and DSR protocol but normalized routing load of GRP have to be optimized in which GRP lags behind the other protocols for IEEE 802.11g MANET networks in dense population of nodes where GRP has good as well as poor NRL response.

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